Preliminary Analysis and Simulations of July 23rd Extended Anvil Case

Goal - To understand the evolution/lifecycle of cirrus anvils

- **Role of mesoscale processes**
  - Deep convection microphysical input/outflow
  - Ambient environmental conditions
  - Convection-induced circulations
- **Role of cloud-scale processes**
  - Particle sedimentation
  - Cloud-scale circulations
  - New particle generation/growth?
  - Radiative processes

=> Impact on Radiative and UT Humidity fields

July 23rd Extended Anvil Case

Approach - Conduct high-resolution simulations of cirrus lifecycle

Tool - Cloud-resolving model w/ resolved ice microphysics, R.-F. Lin
(2-D model with 100-m resolution and bin microphysics/aerosol)

Validating Data - Cloud Ice Field

CRS (G.Heymsfield, L.Li, Z.Wang) ……no COSSIR

In-situ (A.Heymsfield and the Cloud Probers)

Validating Data - Cloud Dynamics

In-situ (B.Demoz, P.Bui, M.Poellot)

Validating Data - Cloud Optical Properties

CPL (M.McGill, D.Hlavka, W.Hart)

PDL (K.Sassen)

MAS/MODIS (S.Platnick, M.King)

GOES (P.Minnis et al)

July 23rd Extended Anvil Case

Initializing Data

Cloud Ice Field

CRS and EDOP (G.Heymsfield, L.Li, Z.Wang, L.Tian)

MM5 (R.F.-Lin, Y.Wang, A.Lare)

In-situ (A.Heymsfield and the Cloud Probers)

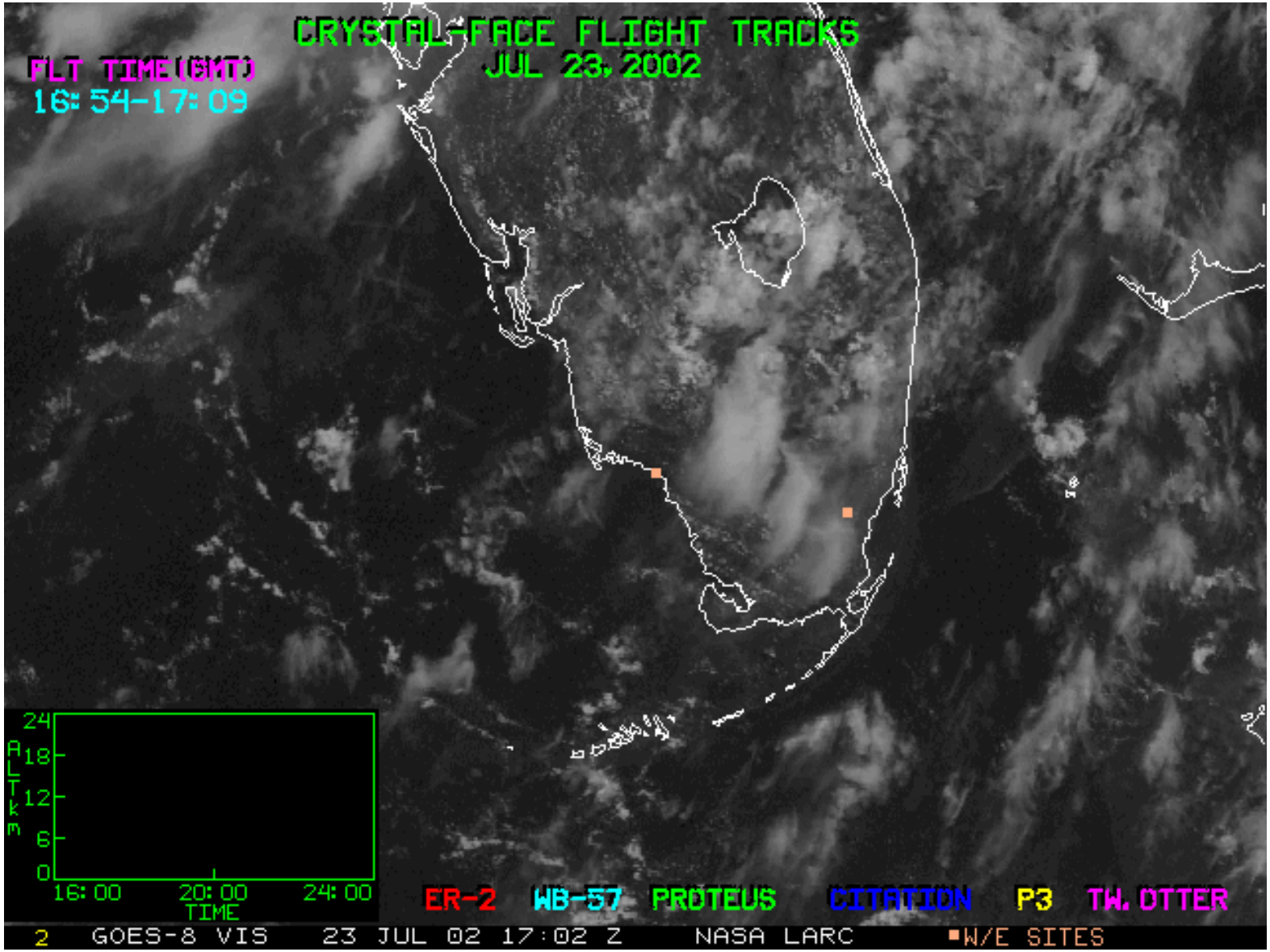
Environmental Data

NWS, CFU, PARCL, and ER-2 soundings
(J.Halverson, L.Miloshevich, B.Demoz, A.Lare)

MM5 and NWS Eta (R.-F.Lin, Y.Wang, A.Lare)

In-situ (B.Demoz, P.Bui, M.Poellot)

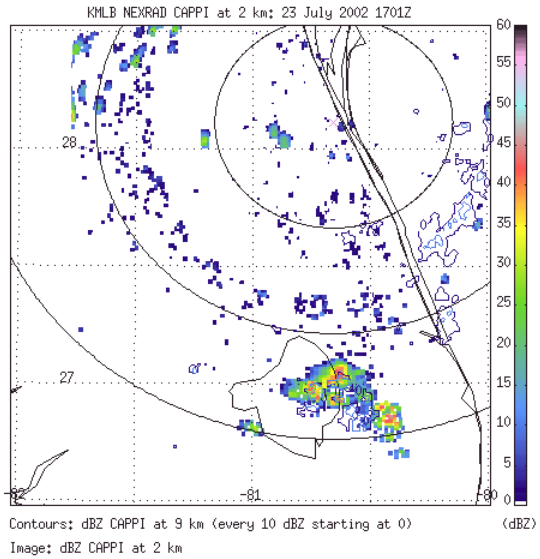
Meteorology/NEXRAD (J.Halverson, T.Rickenbach, A.Lare)


CRYSTAL-FACE FLIGHT TRACKS
JUL 23, 2002
FLT TIME(GMT)
16:54-17:09
24
18
12
6
0
ALT km
16:00
20:00
24:00
TIME
ER-2
WB-57
PROTEUS
CITATION
P3
TW. OTTER
2 GOES-8 VIS 23 JUL 02 17:02 Z NASA LARC
W/E SITES

Starr/GSFC

July 23rd: NEXRAD, 1700-2000 UTC

1700 UTC



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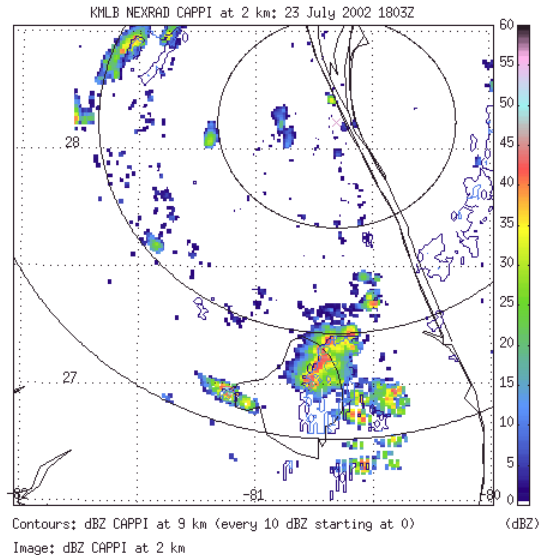

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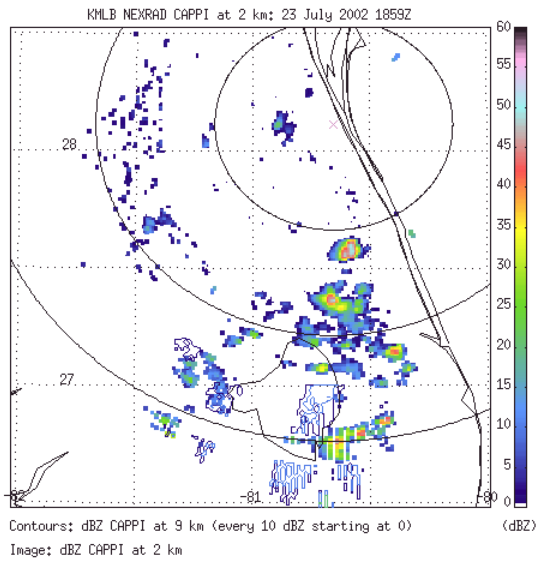

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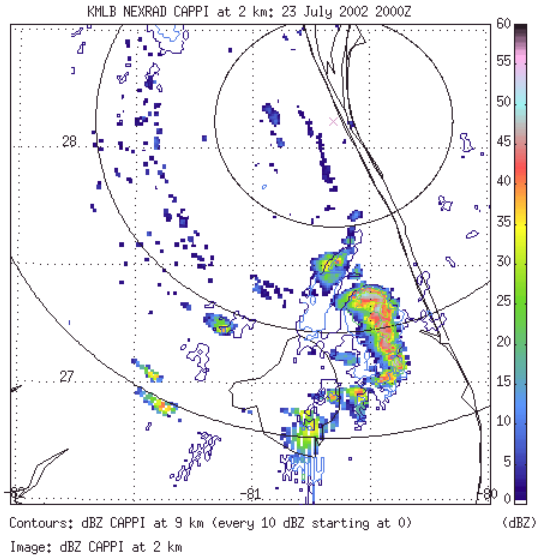
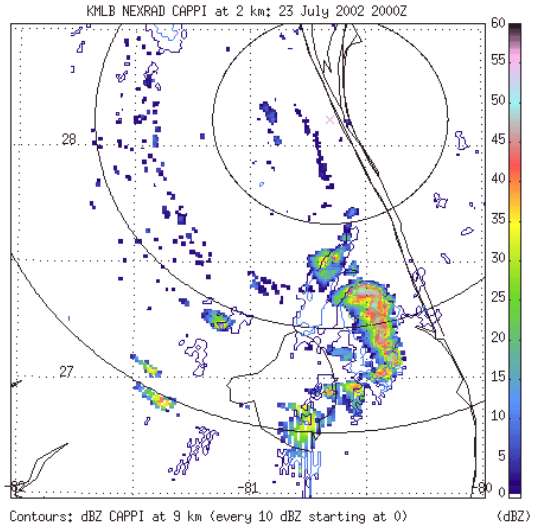


July 23rd: NEXRAD, 2000-2300 UTC

2000 UTC



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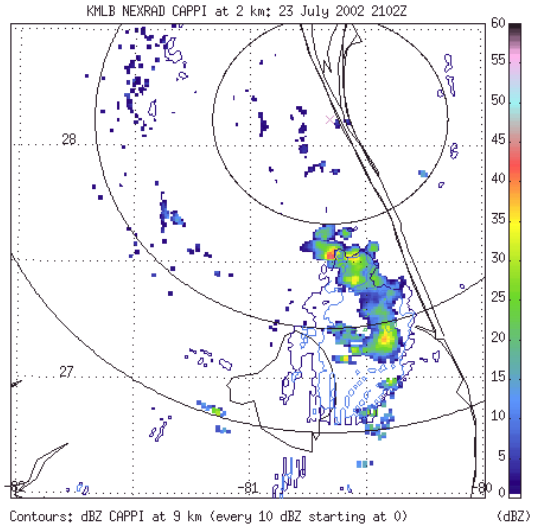
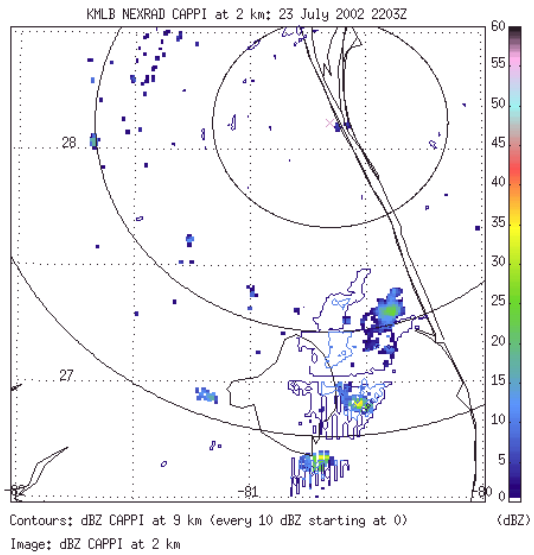
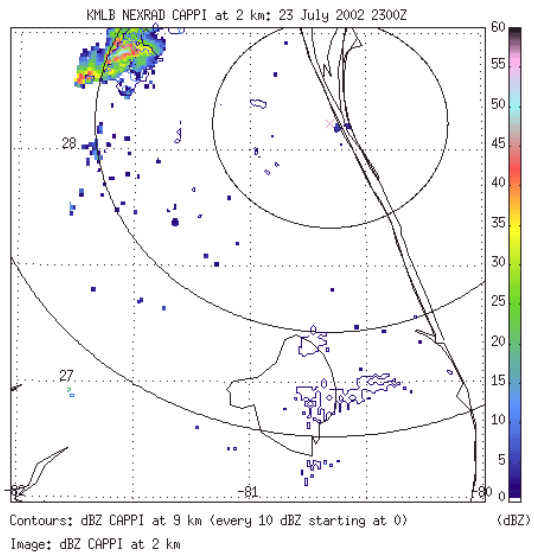


2200 UTC

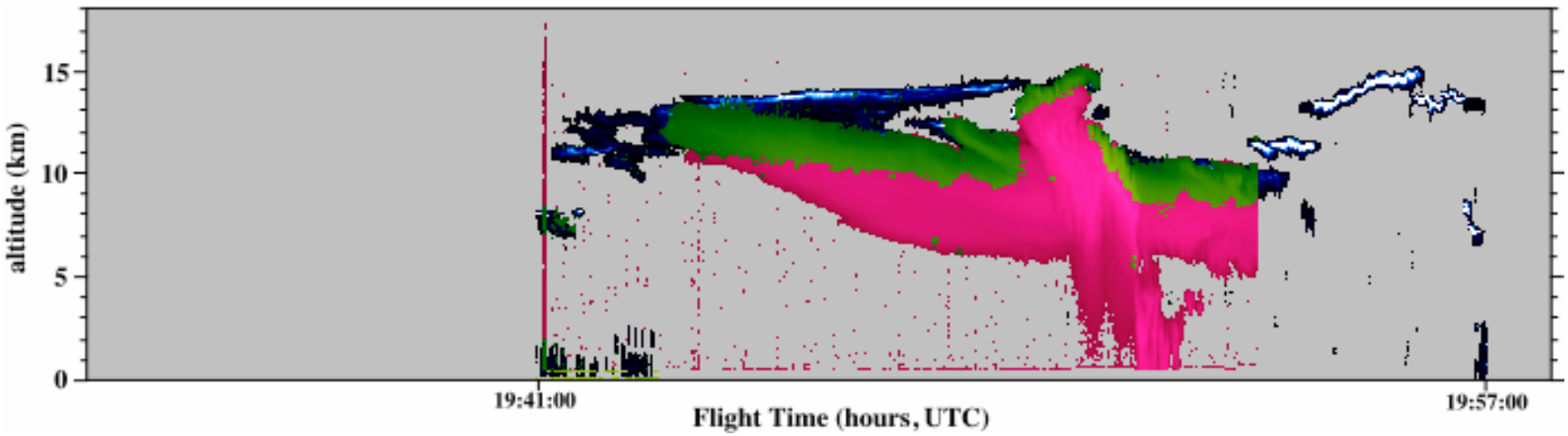


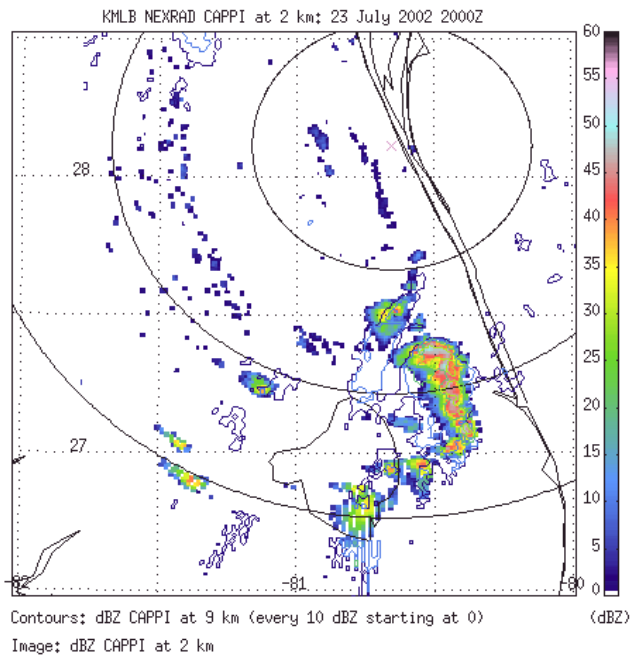
2300 UTC

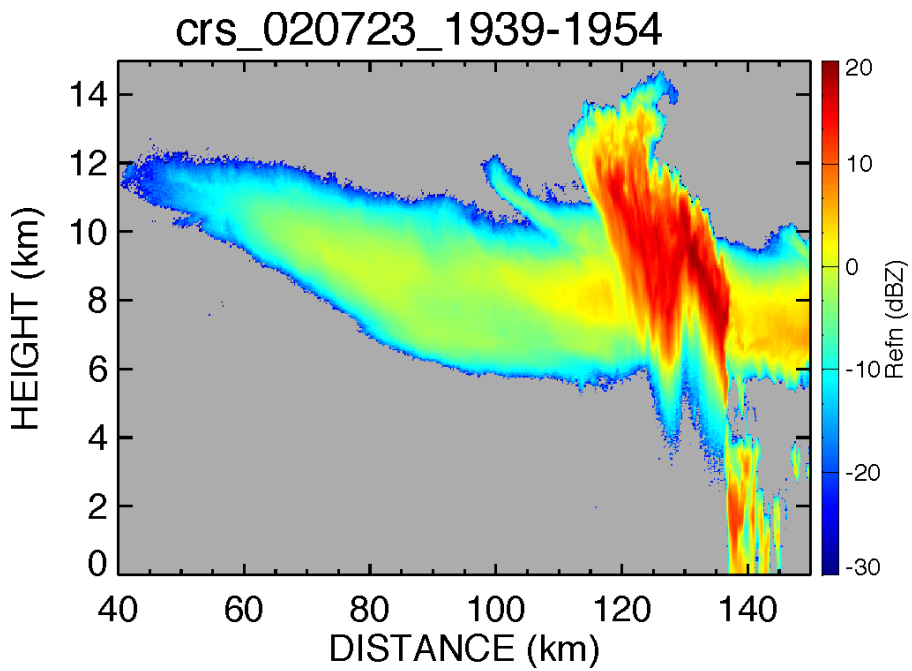


Starr/GSFC

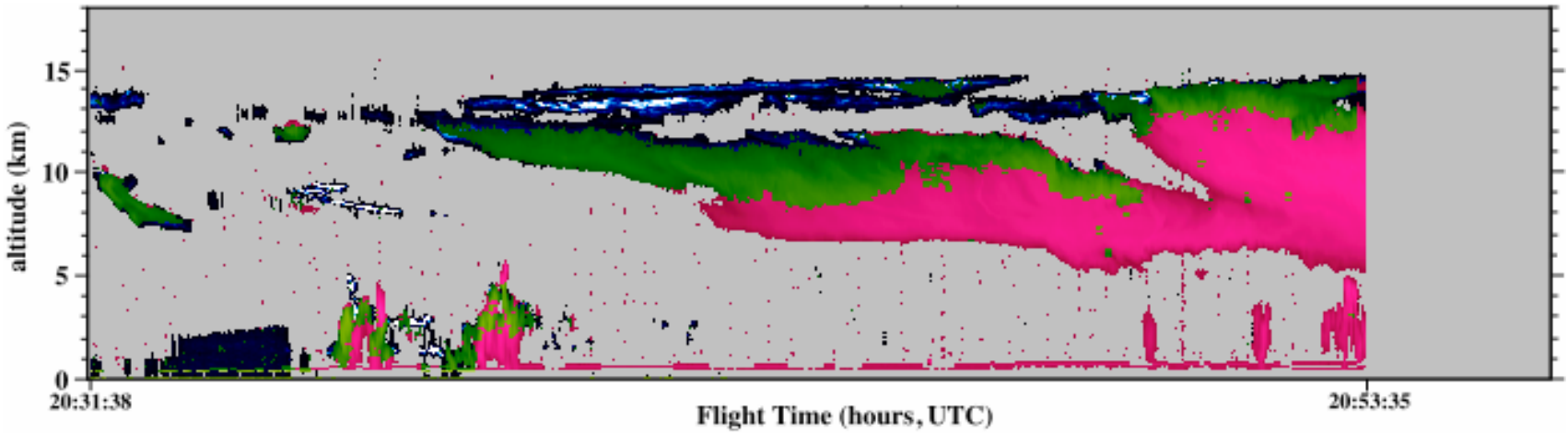
July 23rd: CPL, CRS, NEXRAD and EDOP: 20 UTC

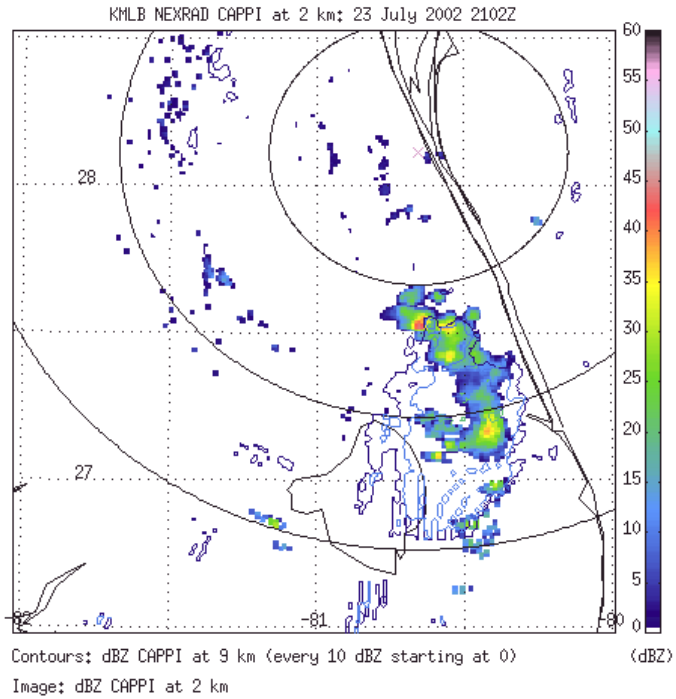


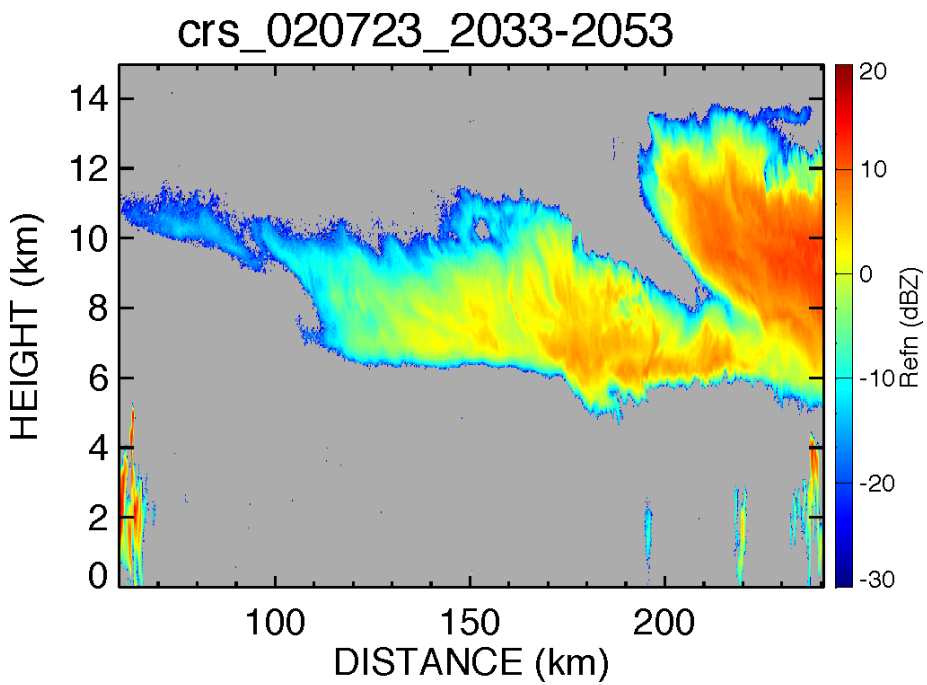




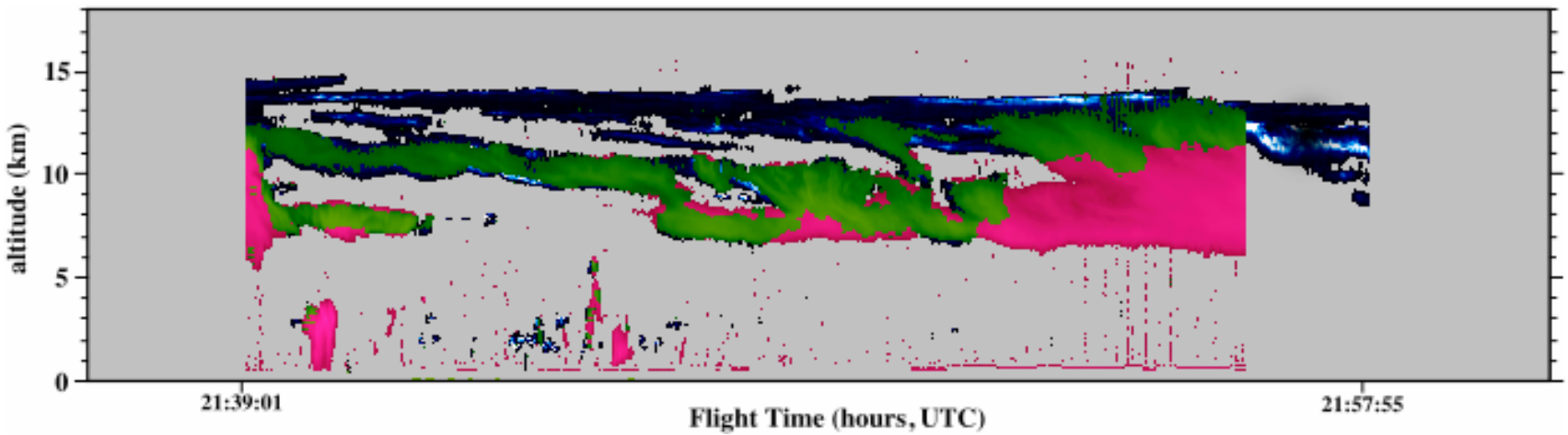
July 23rd: CPL, CRS, NEXRAD and EDOP: 21 UTC

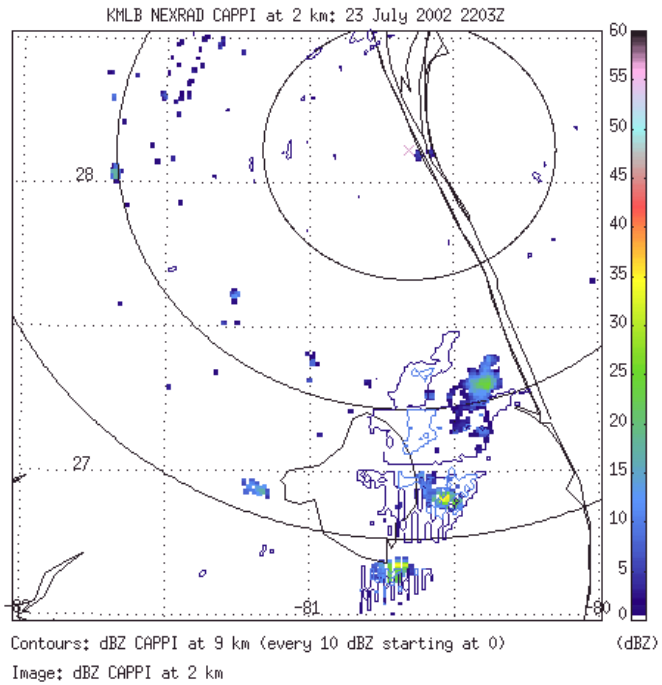


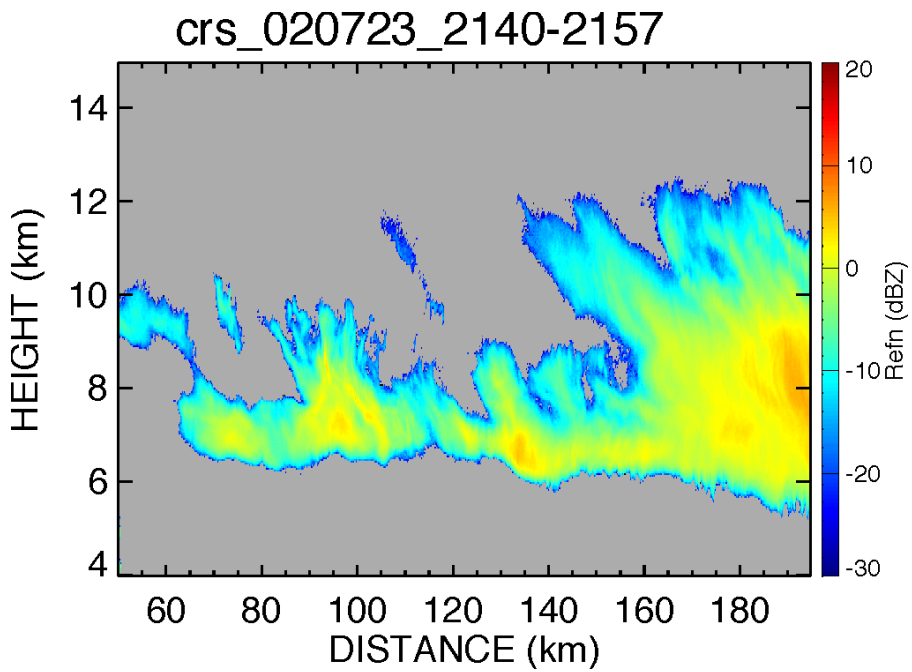




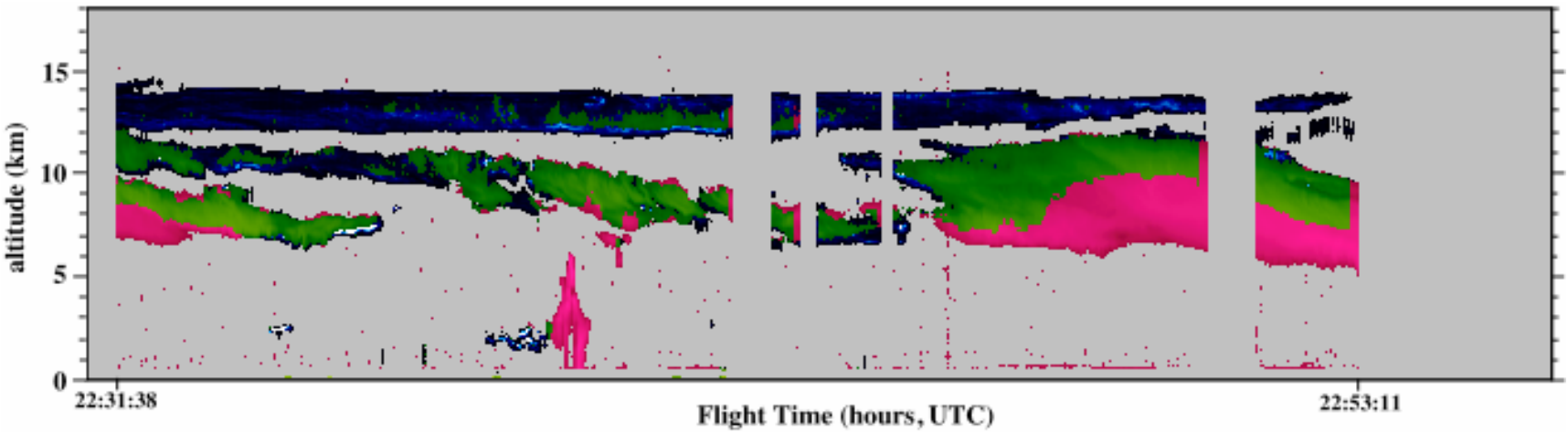
July 23rd: CPL, CRS, NEXRAD and EDOP: 22 UTC

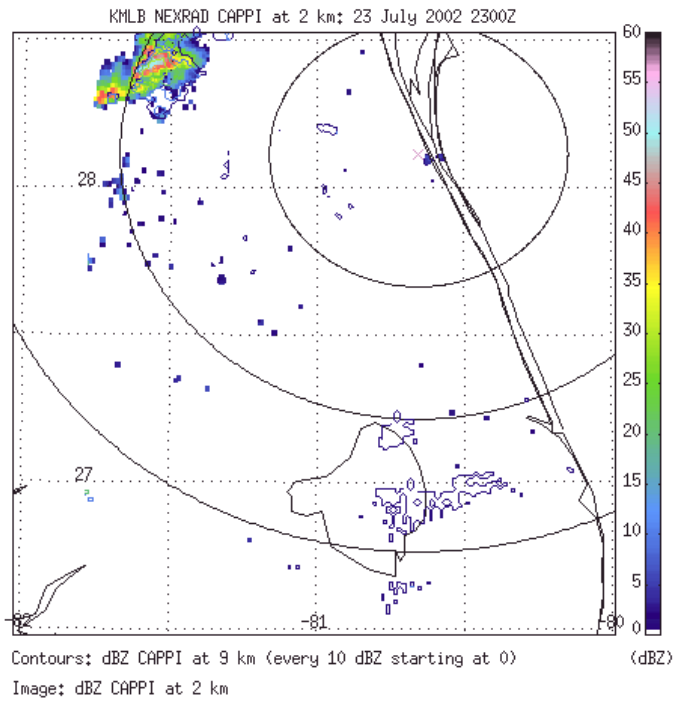


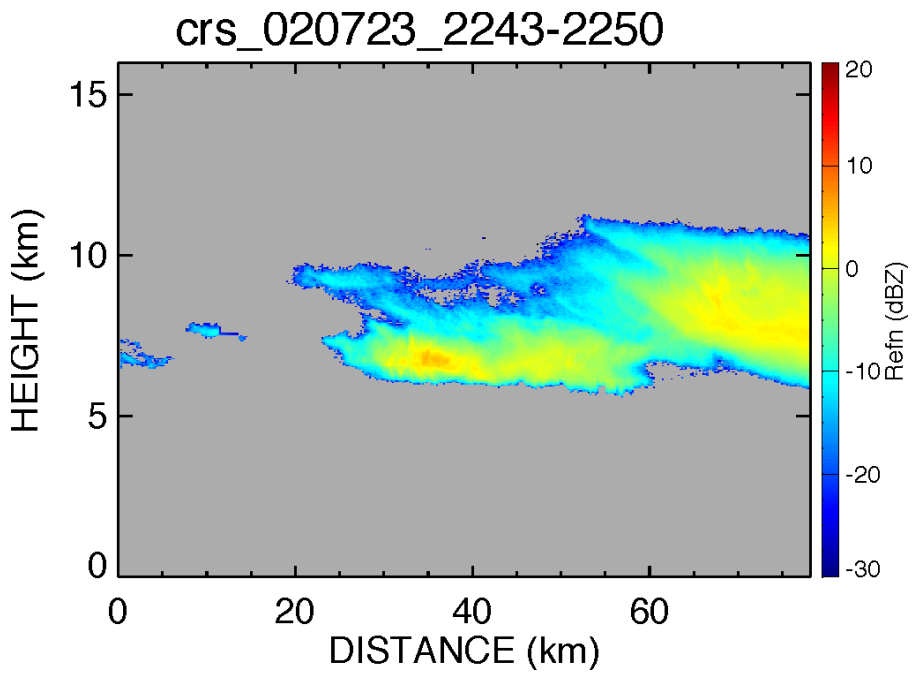




July 23rd: CPL, CRS, NEXRAD and EDOP: 23 UTC

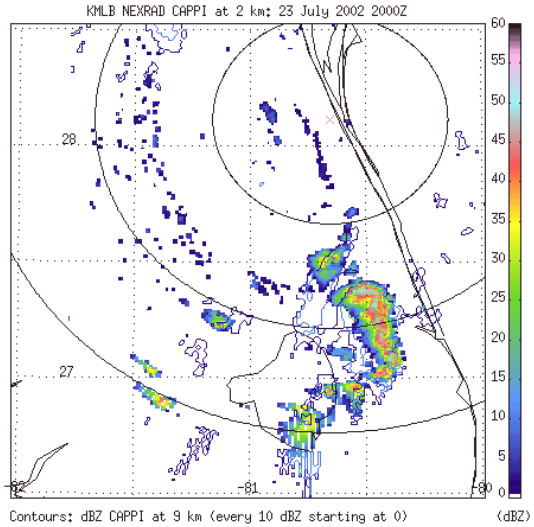






July 23rd: NEXRAD, 2000-2300 UTC

2000 UTC



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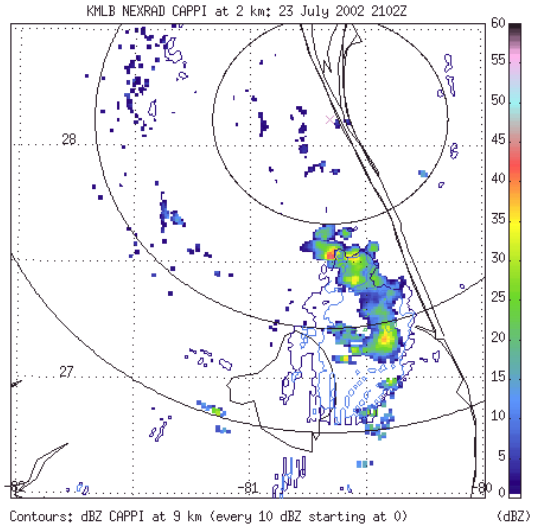

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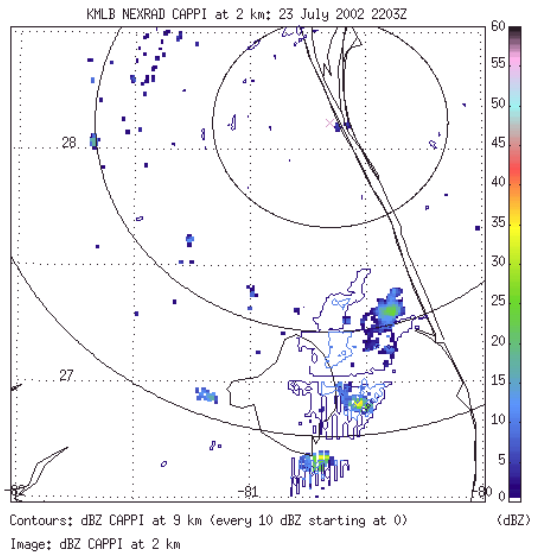
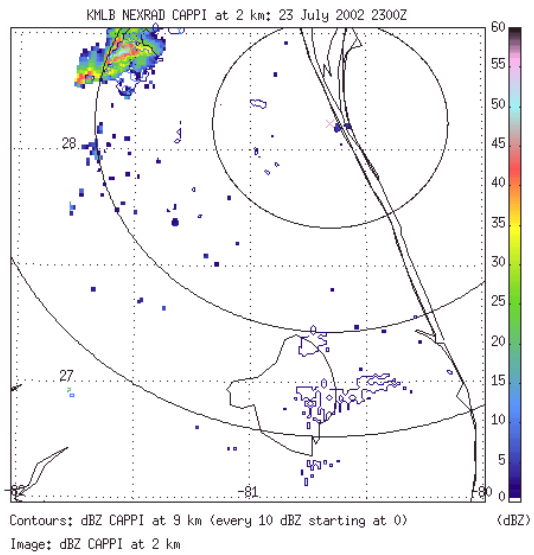


2300 UTC



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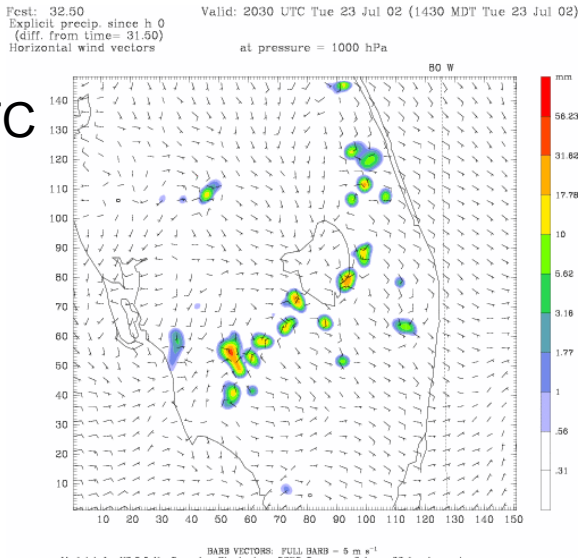
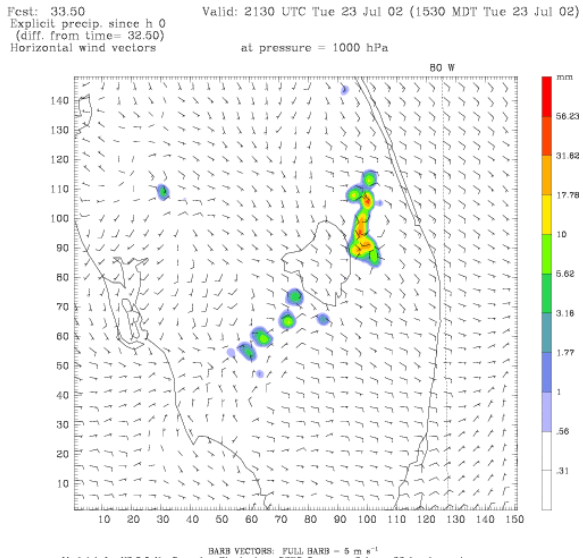
July 23rd: MM5 Precipitation

2030 UTC



2130 UTC



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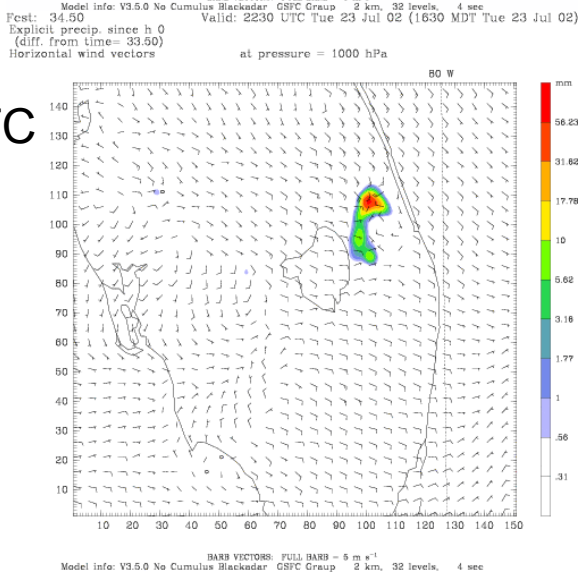
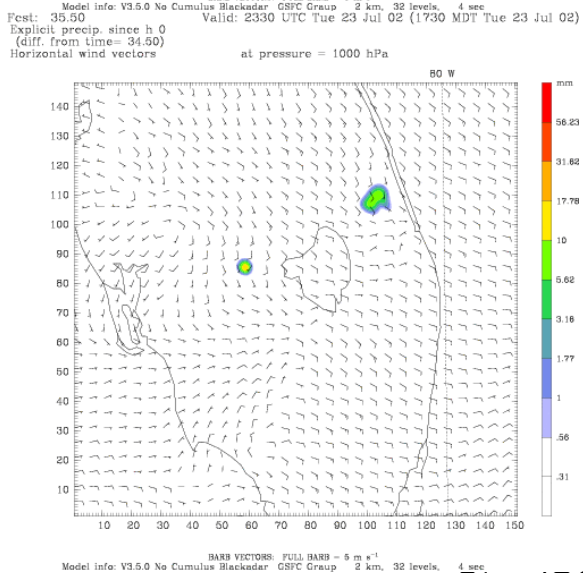


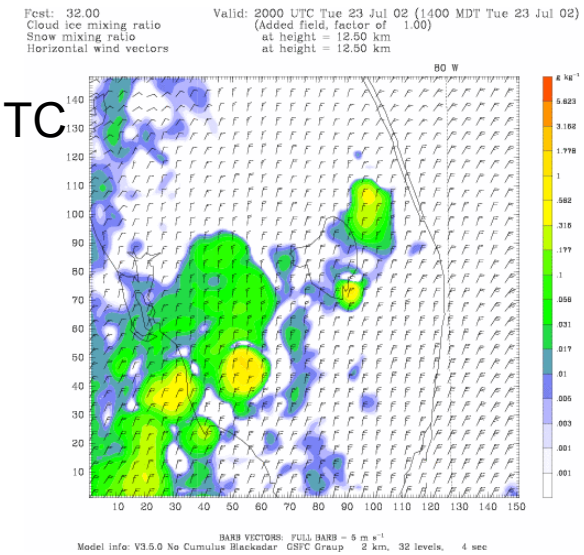
2330 UTC



Starr/GSFC

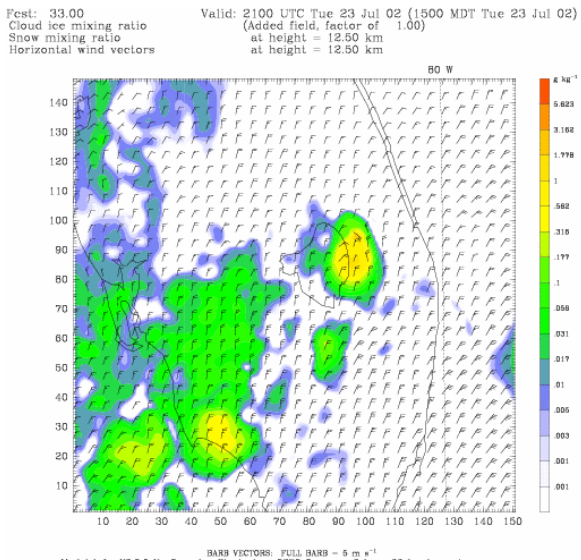
July 23rd: MM5 Upper Air with Cloud Ice

2000 UTC

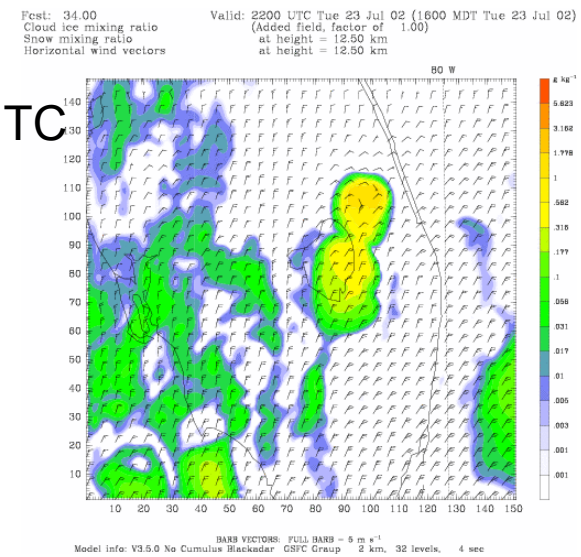


12.5 km

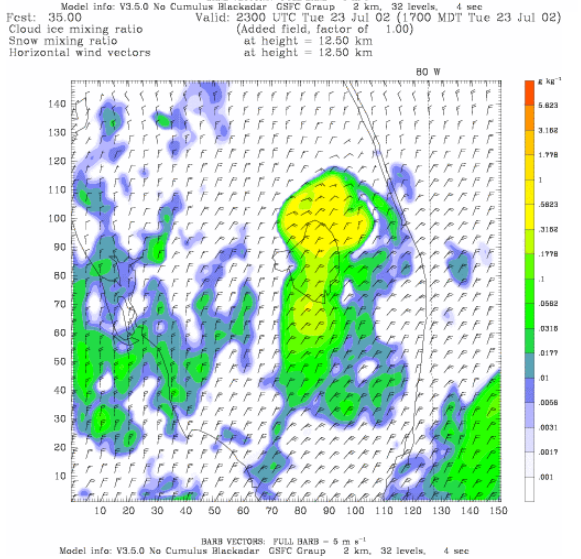
2100 UTC



2200 UTC

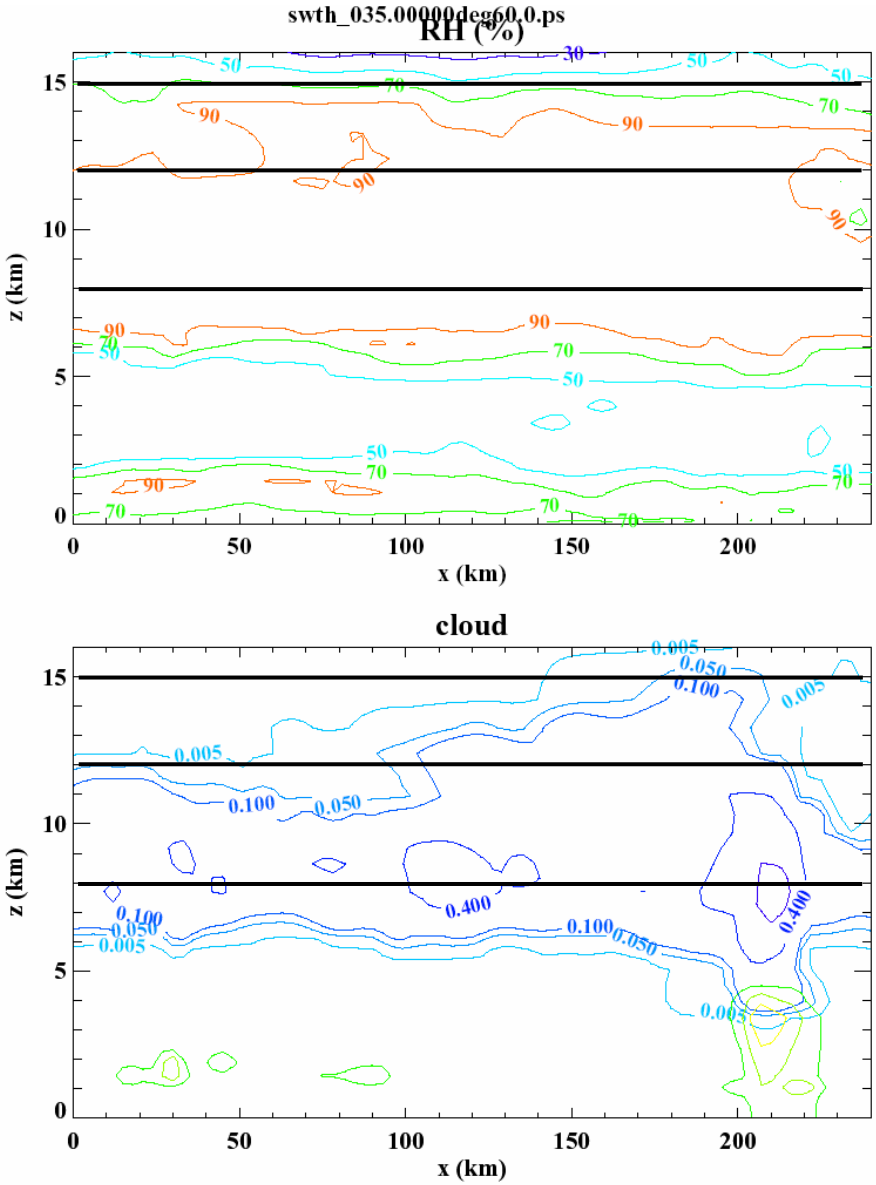


2300 UTC



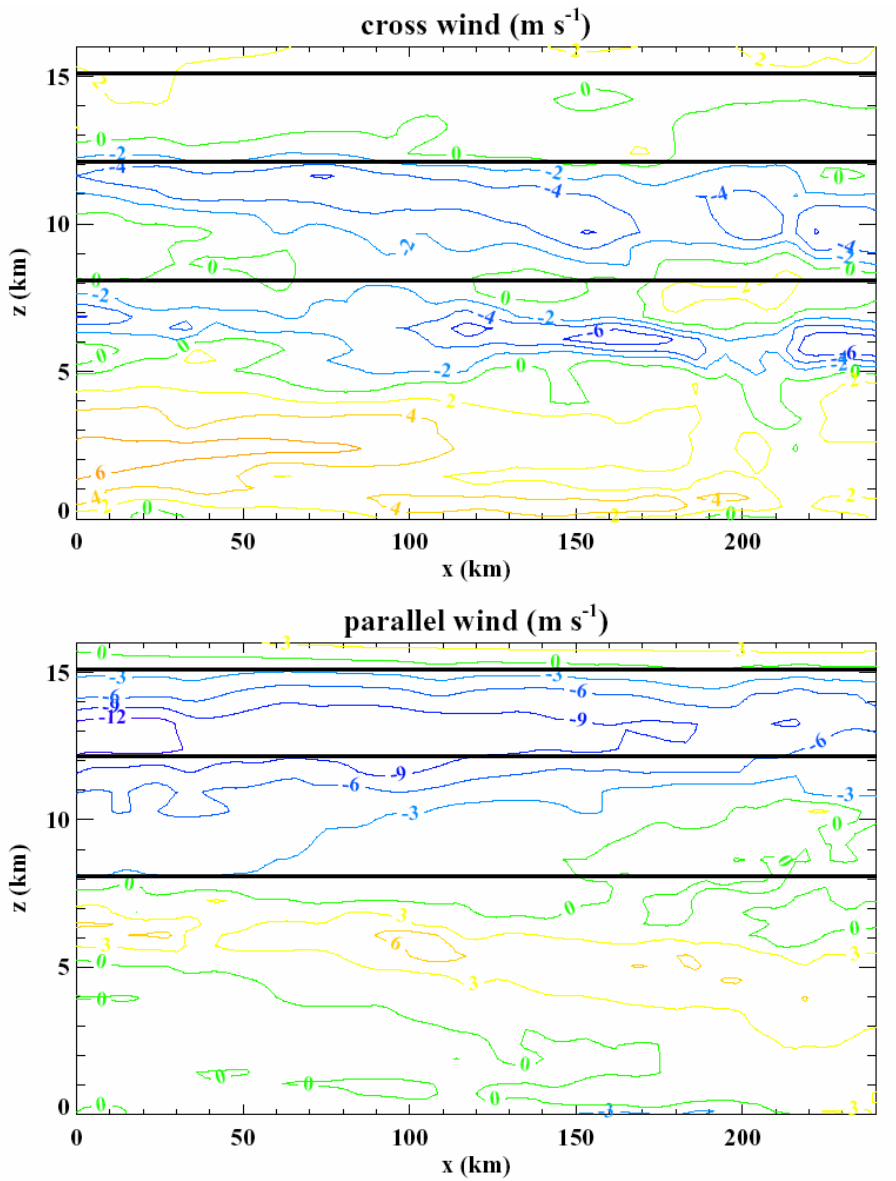
Starr/GSFC

July 23rd: MM5 30-210° Cross-Section , 2300 UTC



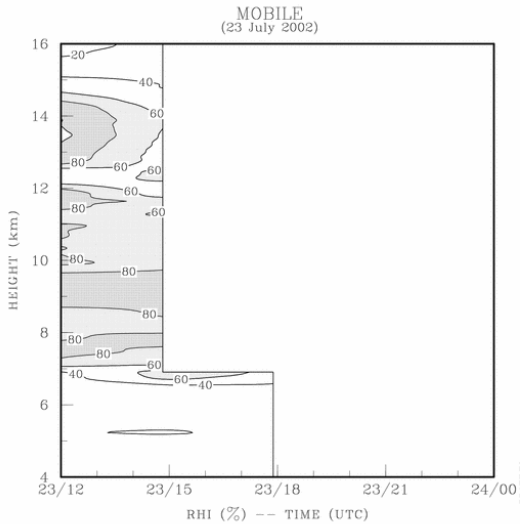
Starr/GSFC

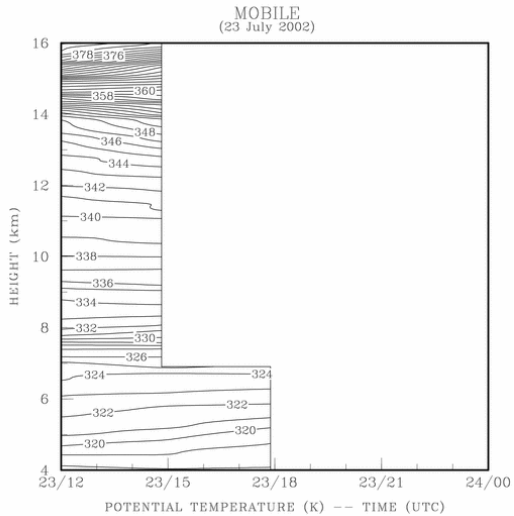
July 23rd: MM5 30-210° Cross-Section, 2300 UTC

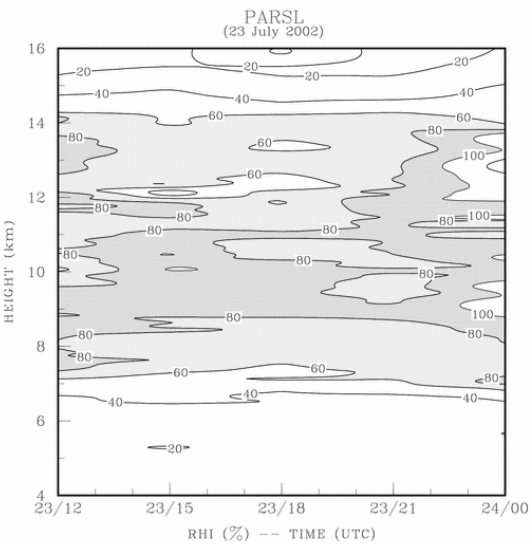


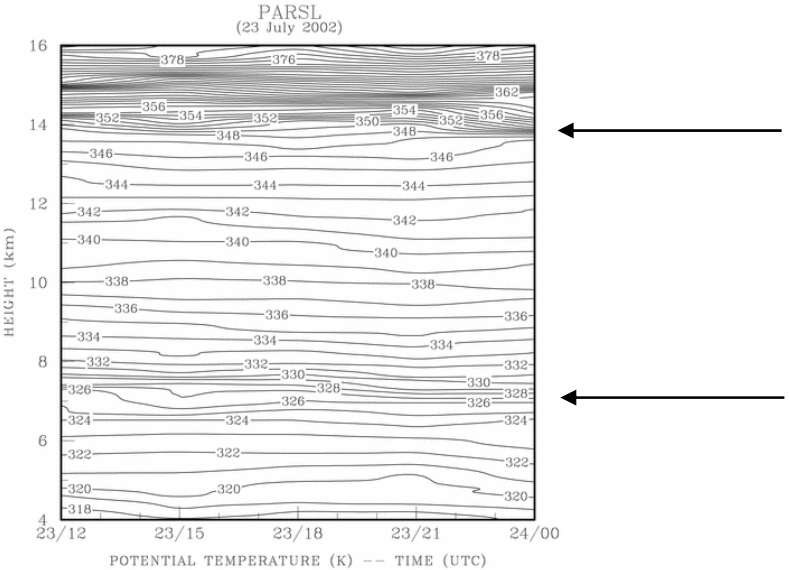
Starr/GSFC

July 23rd: Mobile and PARCL Soundings





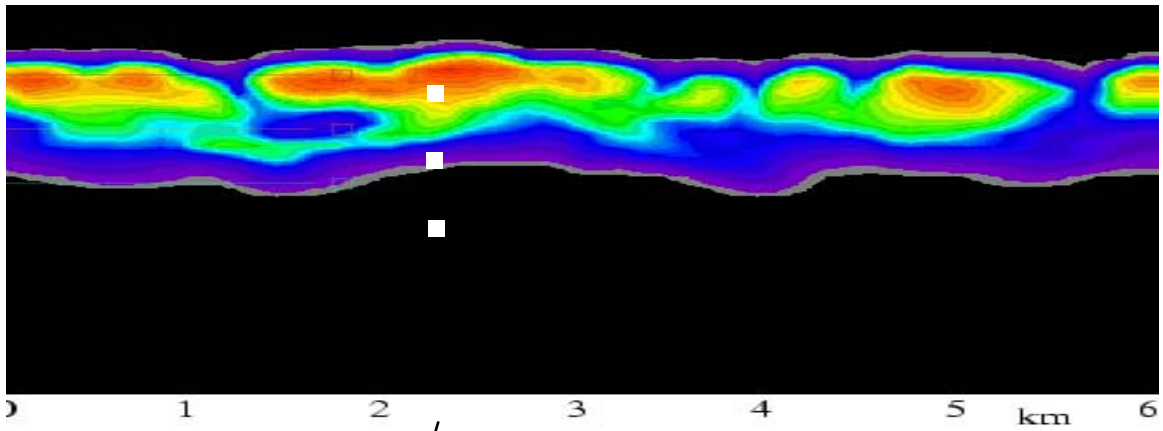




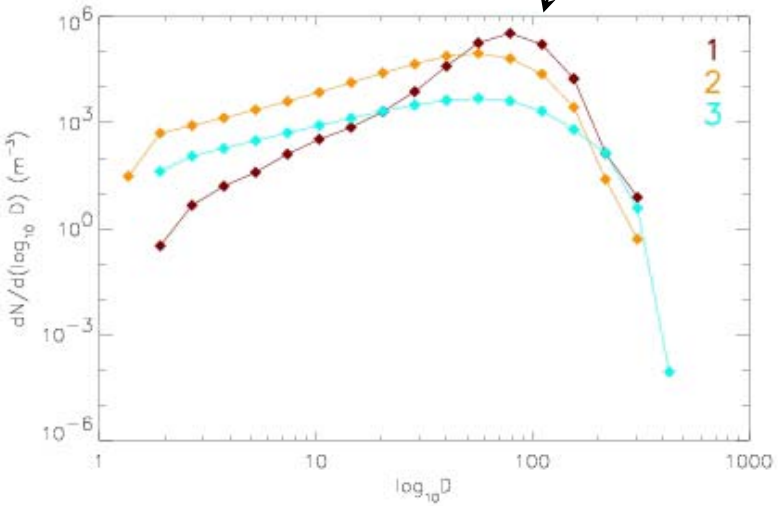
Starr/GSFC

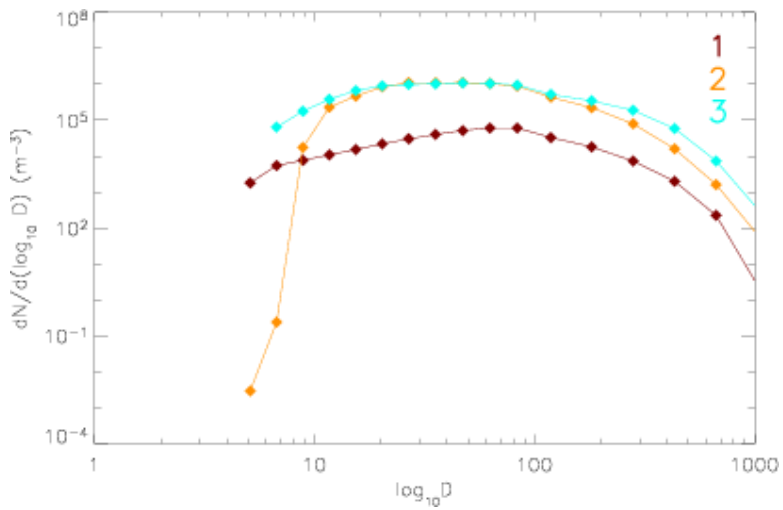
July 23rd: CRM Cloud Ice Field

Idealized GCSS WG2



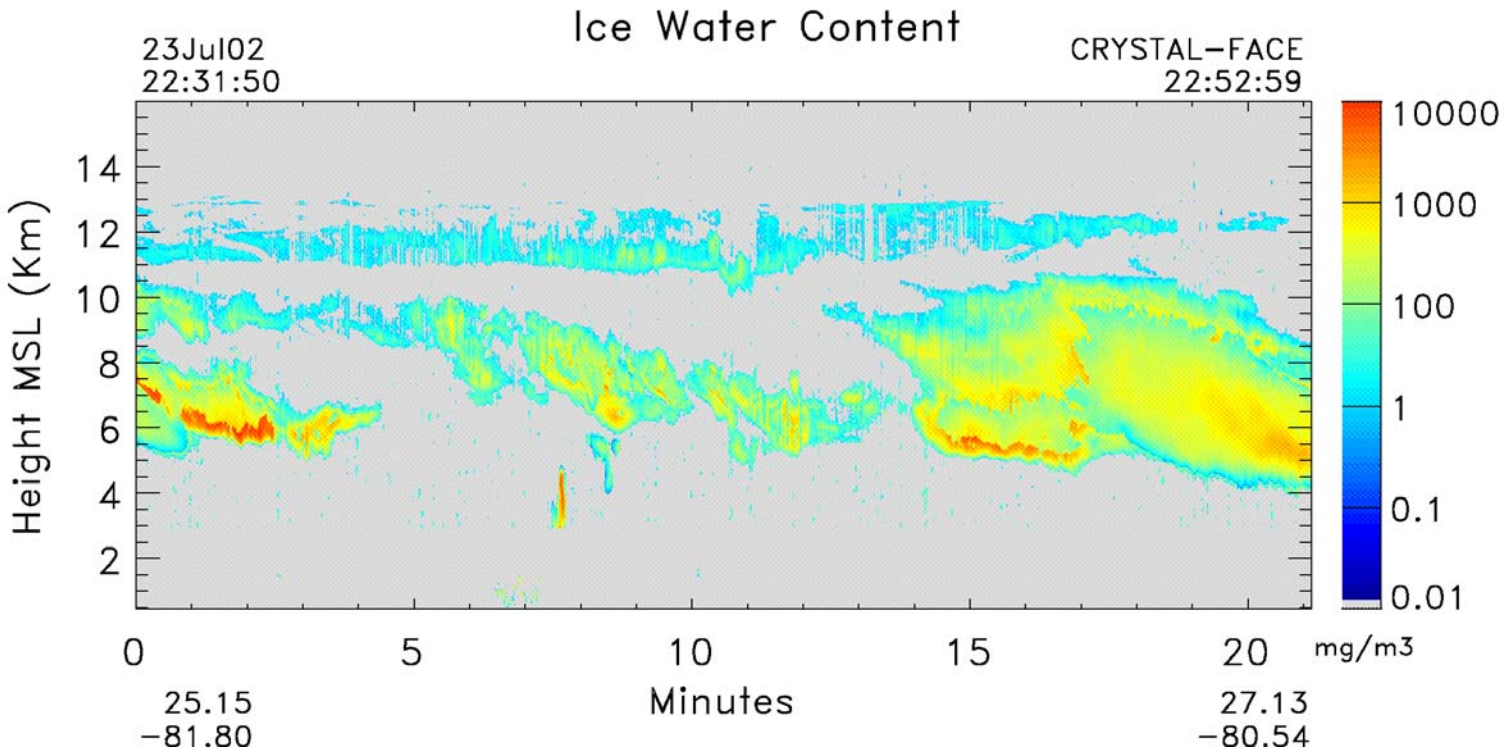
1st CRM of 23rd July - Pure Sedimentation
Initial Cloud Ice from MM5, 12-15 km





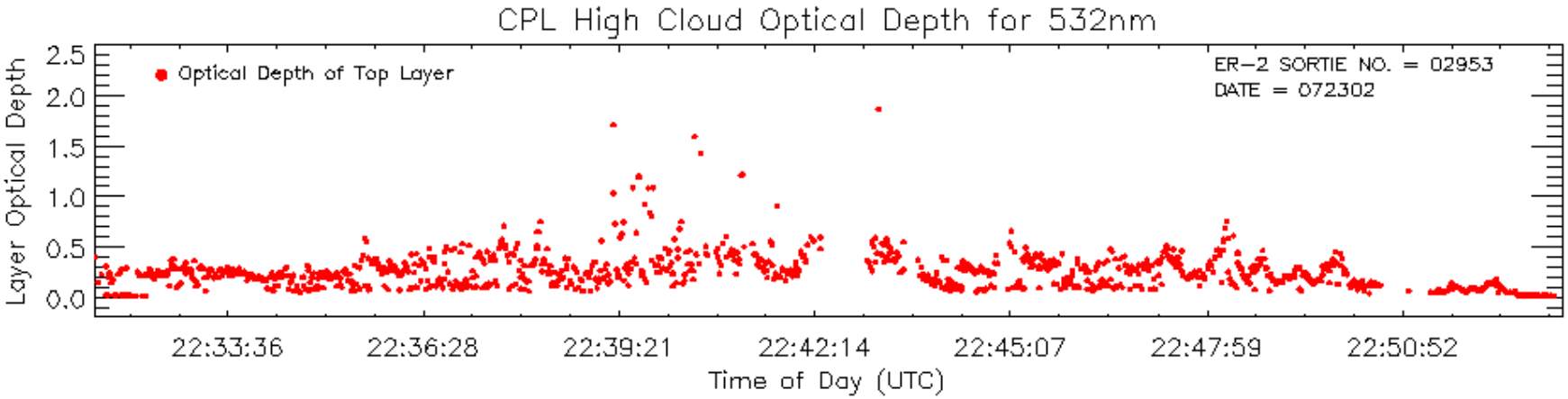
Starr/GSFC

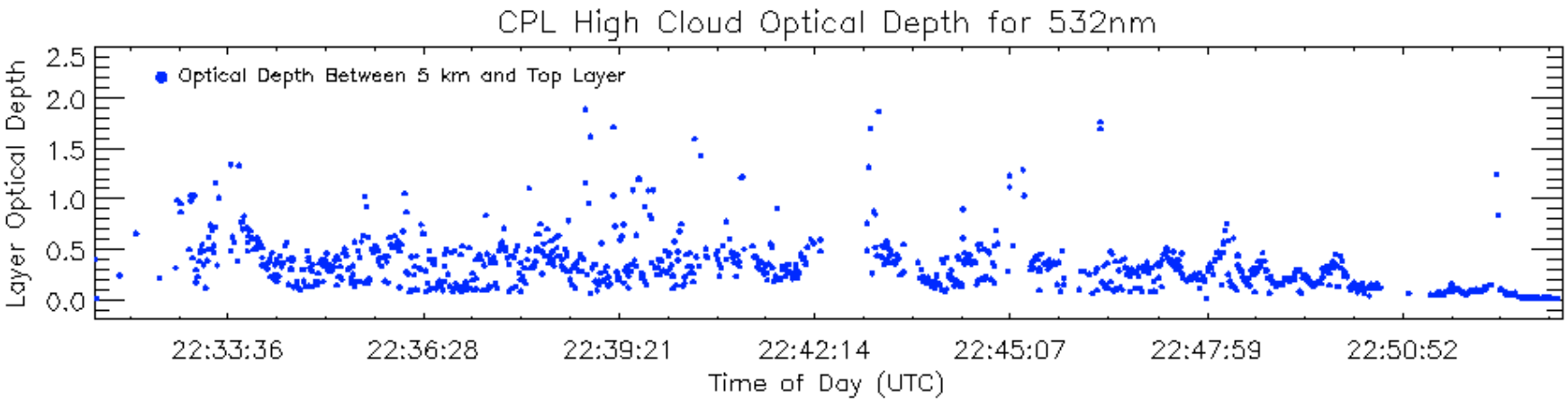
July 23rd: Cloud Water from CRS-CPL-EDOP



Starr/GSFC

July 23rd: Cloud Optical Depth from CPL





Starr/GSFC

Next Steps

- Integrate Cloud Water information to estimate Initial Conditions and Time/Space-Dependent Evolution, specifically IWC(x,t) and N_i(r,x,t)
- Complete Analysis of MM5, Eta, and Sonde data to Characterize Environment
- Iterate 2-D Simulations to Achieve "Best" Result =>Microphysical Consistency
- Compare CRM Cloud-scale Dynamics to *in-situ* Observations (WB-57, Citation)
- Compare CRM Cloud Optical Properties to Observations (CPL, MAS, GOES)
- Evaluate Importance of Mesoscale Circulations (Buoyancy Waves) using CRM

- **More Cases…….**

  July 28th Case Study

  July 29th Case Study

  July 16th Case Study